

ZdravReform Program  
Consultations on Reducing Length of Inpatient Stay for  
Myocardial Infarction  
Task 123.2.4.

Report  
Reducing Length of Inpatient Stay  
for Myocardial Infarction  
(methodical recommendations)

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## Introduction

At present people's morbidity and mortality are still often caused by cardiovascular diseases. Among others the problem of myocardial infarction (MI) patients' rehabilitation is particularly critical, as this disease is more and more often developed by able-bodied, active people, and it results in partial or full loss of working ability. (V.S. Volkov, 1982; V.S. Gasilin, 1989; L.A. Alekseeva, 1994).

Development of methodical approaches to the MI patients' rehabilitation resulted in introduction of the stage-by-stage system of rehabilitation in the 70-th, including discharge of patients in 30 days after macrofocal MI (I.K. Shkhvatsabaya, 1983; L.F. Nikolayeva, 1998).

In the last 20 years the tactics of IM patients' treatment and rehabilitation has changed considerably towards greater radicalism (V.M. Alkhimovich, 1985; I.K. Sledzevskaya, 1989; F.F. Gorbachenkov, 1989).

A certain percent of patients can be characterized by favorable course of the disease. For such patients the probability of lethal outcome is relatively low, and is seldom higher than 1-2% within 1 month after MI. Also, the probability of complications in the first days of the disease is rather low. Thus, this category of patients can be discharged earlier. (M.Ya. Kogan-Ponomarev, 1994).

There are literature sources giving evidence that certain temporal complications (including heavy ones) developed in the first few hours of MI but arrested on-time and successfully, do not adversely affect further disease progress. (V.S. Gasilin, 1984; A.S. Smetnev, 1990; Yu.A. Vasuk, 1991; I.A. Sirkin, 1991; Yu.Ye. Abakumov, 1993).

It is known that early mobilization of MI patients does not result in increase of complications rate. At the same time reduction of LOS leads to a number of advantages, namely: physical, psychological, economical and professional (M.A. Izvekova, 1988; Yu.I. Nesterov, 1990; I.Yu. Yutapov, 1993).

Early activation is broadly practised in foreign hospitals (M.H. Rowe, 1989; R.F. Heller, 1990; H. Lardoux, 1992; J. Alpert, 1993), but up to the present time this experience has not been widely introduced into Russian cardiology practices, although the issue of early activation and discharge of patients is being discussed by some authors (M.A. Izvekova, 1988; Yu.I. Nesterov, 1990; Yu.A. Vasuk, 1991; A.D. Kuimov, 1992; I.K. Sledzevskaya, 1992; I.Yu. Yutapov, 1993; M. Ya. Kogan-Ponomarev, 1994).

Thus, the program of early activation and discharge in 14-16 days can be implemented for a certain category of MI patients. Transitive complications of groups 2-3 developed in the first 48 hours after MI (paroxysmal supraventricular and ventricular tachycardia, fibrillization of heart ventricles, AV block of degree 1-3 under inferior MI, reflectory collapse) that are arrested on-time and successfully do not necessarily serve as a contraindication to early activation.

## **Indications and Contraindications to Early Rehabilitation**

The tactics of early physical rehabilitation and discharge is recommended to the following categories of patients:

- with micro- and macrofocal myocardial infarction without complications and angina, by the third day from the disease onset and during the inpatient period;
- without concurrent chronic or acute diseases that can influence the disease prognosis, and also without mental disorders;
- under successful managed program of shortcut physical rehabilitation;
- with satisfactory results of early exercising tests (EET): tolerance to physical exercising (TPE) of 50 W and more without clinical and electrocardiography signs of myocardial ischemia.

On each patient's case the issue of early rehabilitation should be discussed not earlier than on the third day after the disease course is stabilized and the patient is referred from intensive care unit to a general one. It also has to be agreed on with the patient.

The shortcut rehabilitation program can not be recommended to patients developing the following complications 48 hours after the onset of the disease:

- cardiac incompetence of > degree 1 after Killip's classification;
- reflectory collapse;
- complicated rhythms disorders and conduction impairment, including ventricular and atria extrasystole, paroxysmal anterior ventricular and ventricular tachycardia, ventricular fibrillation, atria-ventricular blocks of all degrees and under any IM localization, intra-ventricular block of all types.

If these complications are developed during the first 48 hours, and prove to be episodic, are timely arrested and do not recur further on, they should not be considered contraindications for being researched.

This method should not be applied to the patients with:

- cardiogenic shock, recurring MI; left ventricle aneurysm; post infarction angina, post infarction Dressler's syndrome; with suspicion in myocardium rupture and functionally important dysfunction of papilla muscles developed at any disease stage;
- echocardiographically registered QS ventricular complex in more than 3 sternum common leads, excluding V1;
- permanent auricular fibrillation;
- WPW syndrome;
- arterial hypertension of 2-3 degree with permanent arterial pressure under treatment being higher than 160/100 mm Hg.

- thrombendocarditis, thrombembolic complications, depreciation of peripheral vessels
- with previous transmural MI (according to the ECG data or with the considerably decreased contractive function of the left ventricle)
- serious concurrent disease; that requires medical treatment (acute and chronic lung diseases; diabetes; liver and kidney incompetence; cerebral insult having occurred during the last 6 months or resulted in serious psychiatric and motor disorders; oncological diseases).

### **Early Rehabilitation Method**

The method of shortcut rehabilitation represents a modified program designed by L. Nikolayeva and D. Aronova (1988), but app. 2 times shorter, so that on the 10-12th day patients are able to walk 1,000 - 1,500 m, and by the time of discharge the walking speed reaches 100 steps per 1 minute; patients can climb the 3rd floor without difficulties (table 1).

Patients' health status should be monitored with the help of the following methods:

- Chest X-ray during the first 48 hours to identify the signs of cardiac incompetence, in the lying position.
- Monitored ECG during first 48 hours in the intensive care unit
- ECG registration in 12 common leads (on a daily basis, before the sub-acute period of MI is formed, later on once every 3 - 5 days, and, finally, 1 day before discharge)
- activity of blood serum counts (asparagine transaminase, creatinin phosphokinase)
- two dimensions echocardiography on the 7 - 14th day (the day before early exercising tests) to assess the myocardium status and avoid complications)
- early exercising tests: veloergometry (VEM) and via-esophaguson electric stimulation (VEES) on the 8 - 14 day (with 1 day interval between the tests) after the coronary active medications are canceled, 1 day before the examination.

VEM is usually performed according to the method, approved by the Russian Academy of Medical Sciences (1988). To cancel VEM the usual criteria are used, but CCF has to be limited by 120 per minute. It is critical to examine the indicators of the functional status of the heart and cardiac contractions frequency (CCF), systolic and diastolic arterial pressure, "double product" indicator and tolerance to physical exercising (TPE).

VEES should be also conducted under CCF higher than 120 per minute. Or, it needs to be stopped earlier according to the generally accepted criteria. It is a common practice to evaluate critical CCF, type and degree of ST segment displacement.

- ECG Holter's monitoring, 2-3 days prior to the suggested discharge. Under this method the following is to be evaluated: type, degree and duration of ST segment displacement, their dependability on CCF, physical exercising, and clinical manifestations. Maximum and minimum CCF demonstrated during the day, rhythms and conduction impairment are to be recorded;

- examination of general cholesterol by fermentative method

The main criteria for early discharge are as follows:

1. Mastering shortcut supervised program of physical rehabilitation without complications and attacks of angina;
2. Stabilization of hemodynamic indicators, ECG, normalization of blood ferments;
3. Satisfactory results of tests on physical exercising:
  - power of veloergometer load is not less than 50W, without clinical and electrographic signs of myocardial ischemia
  - critical CCF under VEES probe not less than 100 per 1 minute
4. Absence of threatening rhythm disorders according to ECG results (extracystolium  $> 1$  gradation after the Laun's classification, paroximal tachyarrhythmia, atria-ventricular and intra-ventricular blocks) and episodes of myocardial ischemia under CCF less than 100 per 1 minute.

The results of tests on physical exercising that are less than satisfactory indicate coronarography.

### **Prognostic Importance of Early Tests on Physical Exercising, Echocardiography and ECG Monitoring**

At the ambulatory stage it is necessary to continue monitoring the patient's health status during at least 16 months. As a rule, this stage includes such methods as: patient's general examination, ECG, EchoCG, VEM, Lipidogram, that is repeated in 3 months (before the patient goes to work) and 16 months.

The post-hospital period can be as follows:

- Favorable, without angina attacks, or with angina of less than 1 FK (after the Canadian classification), without clinical signs of cardiac incompetence (after the Vassilenko and Strazhesko's classification, 1935) and hospitalizations on acute ischemia.
- Satisfactory, with angina attacks of II FK, circulatory insufficiency of not higher than Degree 1, without hospitalizations (or not more than 1) on acute ischemia.
- Unfavorable, with angina attacks of high FK (III, IV), insufficiency of blood circulation of degree 1, relapsing MIs, lethal outcomes, hospitalizations with acute ischemia.

Also, the ability to work and disablement have to be taken into consideration.

It should be remembered that patients with the favorable and unfavorable disease course will have different results of supplementary examination methods, done in the early period (before discharge) (N.I. Tarasov, 1996)

Early VEM probe demonstrates positive results with 95% of the examined patients with unfavorable cases, considerable number of patients having low threshold of physical exercising with TPE results of less than 50W.

If the post-MI period is favorable, as a rule, the results of early VEM demonstrate the average TPE(75W), but sometimes these results can be negative: without clinical and electrocardiographic signs of myocardial ischemia.

Out of all patients having low TPE (less 50W) according to the early VEM data app. 50% of patients return to their work during the first year after MI.

If the post-MI period is favorable and satisfactory by the 16th month the power of threshold physical exercising is to be increased. If the case course is unfavorable TPE has to be kept unchanged.

Thus, TPE increase during the first 16 months of post-MI period serve as an objective criteria for a favorable prognoses.

Test on physical exercising and repeated VEM probes allow us to suggest quite an accurate prognoses for unfavorable course of post-MI period: post-infarction angina and cardiac incompetence.

Of all the indicators of physical exercising probes, the so called “double product” indirectly reflects the myocardial oxygen consumption. Positive VEM probe with low **DP** suggests an important information on an unfavorable prognoses.

Identification of prognostically unfavorable signs of early BEM, namely duration of the performed physical exercises equaling to no more than 6 min. (50W), with positive ECG probe, angina attack, low **DP** (<170 units), and also the combination of the abovestated sings indicate the probability of unfavorable course of post-infarction period, that is characterized by a high risk of angina, cardiac incompetence and lethal outcome, and this helps set duration and pace of in- and outpatient stages of rehabilitation. Confirmation of a high degree of risks serves as an indication to the invasive method of examination and reconstructive surgical operation on coronary vessels.

The group of patients with the low threshold power of physician exercising requires an increased care, as they have both unfavorable work and life prognoses.

As a rule there is no important difference in the indicators of early VEM of MI patients without complications and with transitory complications of 2-3 group in the acute period.

Thus, early VEM probe limited by the generally accepted criteria of probe termination ( but with FCC that is not higher than 120 per 1 min.) is very important prognoses-wise. Such test is harmless and, starting the 2nd week of MI onset, can be taken even from the patients with complicated MI.

On the whole the results of TEES and VEM probes are to be correlated, although ECG signs of positive VEES probe are identified less frequently compared to VEM (64.7% and 71.9% accordingly) (N.I. Tarasov, 1996). The critical FCC is also slightly lower under VEM probe.

It should be marked that it is not possible to obtain the diagnostical criteria for ECG probe cancellation, if the exercising is limited according to FCC (not more than 120 per 1 min.).

In this connection the prognostic meaning of early VEES probe can be interpreted as follows: negative probe is more frequent with the favorable MI course, and positive probe with unfavorable one.

Thus, the received data show that VEES can be widely used for identification of residual myocardial ischemia at the early stage of MI. In its turn it increases the possibilities for evaluation of the patients' rehabilitation prognoses and results.

Early VEES can be done to MI patients with contraindications to VEM probe, and also to patients having orthopedic diseases, intermittent lameness, obesity, AH. VEES is advantageous compared to VEM because under VEES the identified myocardial ischemia is treated much faster than under VEM (as FCC recovers faster).

Although VEES has a number of disadvantages as well. It can not be done to patients with esophagus and upper respiratory organs diseases; slow AV conduction; marked pain syndrome and unpleasant feelings that are directly connected to the probe conduction, and also patients with the pronounced vomiting reflex occurring during the examination.

The results of ECG allow to identify the group of patients with the risk of unfavorable course of post-infarction period: before discharge the signs of asymptomatic ischemia are registered with the majority of patients having unfavorable disease course.

Both during the first 2 weeks after the MI onset and during post-hospital period the following indicators taken under the EchoCG test are of great significance: blowout fraction (BF), final-systolic volume (FSV) and final diastolic volume (FDV) of the left ventricle.

BF of the patients having unfavorable hospital and post-hospital period is evidently lower, and FSV and FDC - evidently higher compared to the patients having favorable disease course. (N.I. Tarasov, 1996)

### **Resume**

Early VEM, with the FCC limitation of up to 120 per 1 minute, is the most informative method for identification of the length of inpatient stay, short- and long-term prognoses, and also indications for invasive examination.

As a rule, early probe is positive with the prevailing majority of patients having unfavorable post-infarction course, it being known that some patients may have TPE of less than 50W.

Length of inpatient stay for such patients should be extended. Besides, low TPE indicates coronary angiography. Almost all patients having positive VEM, especially if accompanied by low TPE, prove to have defects of coronary arteries.

Under the positive results of VEM probe, with FCC limitation of up to 120 per 1 minute, the lower TPE the patient has, the greater is the probability of unfavorable post-infarction course. Besides, VEM probe should be preferred among other examination methods, because its result provides the ground for the proved recommendations on the allowable physical exercising after discharge.

It is not worth discussing the qualitative differences of prognostic value of VEES and VEM. The preference of either of them depends the indications and contra-indications of each patient to a certain method, and is to be carried out individually.

Both tests should be taken when the patient has doubtful results of any of these tests.

The information value of ECG is slightly lower. The results of this test do not provide additional information: as a rule, almost all patients having positive VEM probes display signs of asymptomatic ischemia heart disease, and some patients, including patients having positive VEM probe, can fail to display the pathologic changes under ECG test. Consequently, ECG method confirms the results of early VEM probe, but can not serve as the main indication for an early discharge of MI patients.

Echocardiographic indicators of the contractive function of the left ventricle also do not serve as an independent indication in determining LOS. BF, FS<sub>V</sub> and FDV values conform with the clinical evaluation of the patients' state and confirm the results of other examination methods, such as: BEM, VEES, ECG.

The program of early activization of patients with the shortcut inpatient period prove not to cause complications provided the criteria of the patients' selection to the group of shortcut rehabilitation are strictly followed. Moreover, early rehabilitation provides a psychologically favorable impact on patients. Patients, who started to walk earlier, feel more confident, and are more optimistic about their recovering and returning to work.

Thus, the use of the program of early activization and reducing length of inpatient stay is quite possible for a certain category of MI patients. The suggested criteria for an early discharge allow us to identify two groups of patients, one of them with low risk of unfavorable disease course. These patients can be discharged from a hospital and be transferred to the



cardiological sanatorium in 14 days. The patients of the other, high risk group should undergo coronagraphic test and be under closer observation of physicians and receive more active treatment methods (including surgery).

Specialists of the Kemerovo Cardiological Center have conducted an analyses of direct and long-term results of MI patients' treatment (both according to the generally accepted method /group K -82 patients/and shortcut method (group A - 105 patients/).

The patients of Group K underwent rehabilitation based on the usual 3-5 weeks program, with discharge in 28 days.

The length of inpatient stay of Group A was twice less, that is 14 days in average. The length of temporal loss of working ability in the general group was also much shorter (table 2).

The results of long-term observation showed no difference between the two groups regarding clinical course, lethal outcome rate, repeated and relapsing MI, quantity of patients having angina and cardiac incompetence after MI. No difference was found in terms of working ability and disablement (table 3).

Reducing length of inpatient stay of MI patients up to 14 days is economically efficient due to the cut of expenses spent on the patient's stay in a hospital, which is critical in the modern conditions of economic difficulties that Russian health care is experiencing now.

The application of the shortcut rehabilitation method for a certain category of MI patients will reduce the period of temporal loss of working ability by 25-30 days in average, not causing any complications in the post-infarction period.

Table 1 The shortcut program of physical rehabilitation of MI patients

Stage of physical activity	Day-to-day exercising	Days from the	on set of MI
		Microfocal MI	Macrofocal MI
<b>I</b>	Turning, movement of extremities, eating and washing while sitting in the bed	<b>1</b>	<b>1</b>
<b>II</b>	The same + sitting in the bed with dangling feet, using the side-chair  The same + walking in the ward, eating at a table	<b>2</b>  <b>3</b>	<b>2-3</b>  <b>4</b>
<b>III</b>	The same + walking in the hall at a distance of 50m 3-4 times a day, using common toilet	<b>4</b>	<b>5-6</b>

	The same + walking in the hall without limitations, climbing a stairway 1 floor up	<b>5-6</b>	<b>7-8</b>
<b>IV</b>	The same + walking in the street at a distance of 500 m - 80 steps a minute, climbing a stairway 1 floor + 1 span up	<b>7-8</b>	<b>9-10</b>
	The same + walking in the street - 100 steps a minute at a distance of 1000-1500m, climbing a stairway 2 floors up	<b>9-10</b>	<b>11-12</b>
	The same + walking in the street at a distance of 2000m (with an interval), - 100-110 steps a minute, climbing a stairway 3 floors up-prior to the transfer to the sanatorium	<b>12-13</b>	<b>13-16</b>

Table 2 The length of inpatient treatment and temporal loss of working ability in Group A (general), and Group K (control)

Length, M±m	GROUPS		P
	A	K	
	DAYS		
General in the group	In-patient	treatment	<0.0
Microfocal MI	14.1±0.3	28.5±0.3	1
Interior MI	14.0±1.0	28.5±1.4	<0.0
Anterior MI	13.9±0.4	29.0±0.5	1
MI with complications of 2 & 3gr.*	14.2±0.5	28.1±0.3	<0.0
	16.0±0.5	30.0±1.0	1
	Temporal loss	working ability	<0.0
			1

General in the group	of	113.0 $\pm$ 3.9	<0.0
Microfocal MI	86.2 $\pm$ 3.4	113.0 $\pm$ 14.8	1
Interior MI	74.8 $\pm$ 12.1	110.7 $\pm$ 5.4	
Anterior MI	80.2 $\pm$ 4.4	116.4 $\pm$ 4.4	
MI with complications of 2&3	95.8 $\pm$ 5.7	143.5 $\pm$ 5.3	<0.0
gr.*	88.6 $\pm$ 8.6		1
			<0.0
			1
			<0.0
			1
			<0.0
			1
			<0,0
			1

Table 3 The results of long-term clinical observation and social outcome of patients of Group A (general) and Group K (control)

Indicator (n,%)	Group A	Group K	P
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	n=101 (100%)	n=81 (100%)	
Clinical course of disease	32 (31.6)	14 (17.3)	
1. Favorable	47 (46.5)	36 (44.4)	
2. Satisfactory	22 (21.7)	31 (38.3)	
3. Unfavorable			
Post hospital course of disease			
1. Stenocardia I, II ...	52 (51.4)	45 (55.6)	
2. Stenocardia III, IV ...	11 (10.8)	12 (14.8)	
3. Cardiac Incompetence of more than 1 degree	4 (3.9)	7 (8.6)	
4. Relapse of MI	2 (1.9)	1 (1.2)	
5. Repeated MI	4 (3.9)	9 (11.1)	
6. Repeated hospitalization on acute condition of ischemia	23 (22.7)	29 (35.8)	
7. Death	2 (1.9)	3 (3.7)	
Social outcome			
1. Fell out of investigation	4 (3.9)	1 (1.2)	
2. Disablement of III degree	15 (14.8)	5 (6.2)	
3. Disablement of II degree	16 (15.8)	20 (24.70)	
4. Disablement refused	1(0.9)	0	
5. Retirement of age	2 (1.9)	1 (1.2)	
6. Started to work	63 (62.3)	52 (64.2)	